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ABSTRACT

This teacher's guide on earthworms includes four major sections: (1) introduction, (2) caring for earthworms in the classroom, (3) classroom activities, and (4) the appendix. The introduction includes information concerning grade level, scheduling, materials, obtaining earthworms, field study, classroom clean-up, and records. Caring for earthworms and instructions for preparing a worm box are found in the second section. The classroom activities section includes such activities as introducing earthworms, outdoor-indoor activities, experiments, worms in the rain, worm food investigations, worm races, winter worms, underground activities, and other animals children may find. The appendix includes possible earthworm suppliers. (DS)

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teacher's guide for earthworms

SE 033 234

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Long squirmmy worms.
Small little worms.
Making tunnels in the dirt.
~~In~~ Small white things.
Follow the same track
Seeing small baby worms.
~~Set~~ Feeling the worms.
Looking through the magnefy glass
Doing the twist.
looking at small white things.
The worm I had was wet.
Some worms are dry & wet
worms come in all sizes.
big little fat ~~sn sm~~
~~squirmmy~~ sninny.
long wet worms ~~Coat~~
crawling up your sleeve.
Worms eating ~~Oatmeal~~
~~Oats~~ cornmeal.

AUG 1971

teacher's guide for
earthworms

elementary science study

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The Earthworms Unit
Teacher's Guide for Earthworms
Materials for Earthworms

Related Units
Brine Shrimp
Butterflies
Crayfish
Eggs and Tadpoles
Mosquitoes

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preface

The Elementary Science Study is one of many curriculum development programs in the fields of science, social studies, and mathematics under preparation at Education Development Center, Inc. EDC (a private nonprofit organization, incorporating the Institute for Educational Innovation and Educational Services Incorporated) began in 1958 to develop new ideas and methods for improving the content and process of education.

ESS has been supported primarily by grants from the National Science Foundation. Development of materials for teaching science from kindergarten through eighth grade started on a small scale in 1960. The work of the project has since involved more than a hundred educators in the conception and design of its units of study. Among the staff have been scientists, engineers, mathematicians, and teachers experienced in working with students of all ages, from kindergarten through college.

Equipment, films, and printed materials are produced with the help of staff specialists, as well as of the film and photography studios, the design laboratory, and the production shops of EDC. At every stage of development, ideas and materials are taken into actual classrooms, where children help shape the form and content of each unit before it is released to schools everywhere.

acknowledgments

The idea for the EARTHWORMS unit grew out of the Biological Environments Development Group, which met in the summers of 1964–1965. Charles Botticelli and William Meadows taught the unit in several classrooms, and Botticelli and Lynn Margulis wrote a manuscript in 1967. Christopher Hale, Steven Manning, and I taught from this manuscript at the Parker School and the Hosmer School in Watertown, Massachusetts. Botticelli and Rose Lea Crowley observed these and later developmental classes.

Lea Crowley and I taught the unit again in the Woodland School in Weston, the Andrew School in Boston, and the Concord Junior High School in Concord, Massachusetts. It was in these classes that field study became central to the activities. A Working Paper was written, based largely on things that happened in these classes.

The present edition includes information from the reports of teachers who trial taught the unit in their classes.

The photographs were taken by Victor Stokes, Joan Hamblin, and Allan Leitman. Adeline Naiman edited the manuscript, and Nancy Weston designed and oversaw production of the book. The drawings and handwritten notes are by children in the Andrew School and the Woodland School.

Merle S. Bruno

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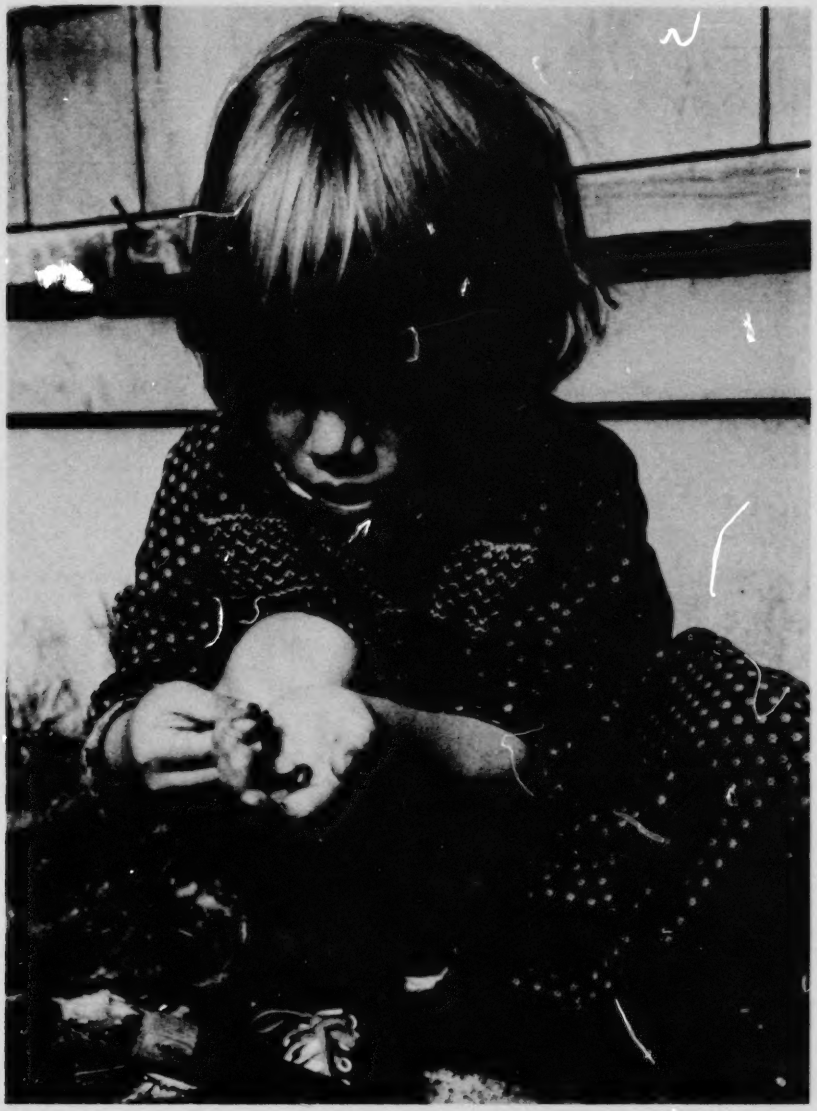

introduction

Earthworms live in the soil all around us. We rarely think about them or notice them until they come out after a big summer rain or we want some for fish bait, but they are of considerable importance in aerating and enriching soil. Most people have seen the adult stage of the common earthworm – at least from a distance – but it is also easy to observe the egg cases, the young worms, and the habits of the animal as well. In the following pages, very simple techniques for the care and breeding of earthworms are suggested, making them remarkably easy to raise, even for young children.

Watching worms raises questions in the minds of the children:

"Where do they come from?"
"When will the eggs hatch?"
"Do the worms have to live in this dirt?"
"What do they like to eat?"
"Can a worm live if it's cut in half?"

The children can answer such questions themselves by watching their worms and experimenting with them. They can watch how the worms act when they put them in sand or in water. They can give a worm the choice of dry soil or wet soil to see where it will go. They can find out where worms live out-of-doors by going out and looking.

The children use a variety of plastic boxes and tubes, paper cups, and cardboard cartons to set up experiments. The results from these first experiments usually lead to additional questions.

"If the worm went to wet sand instead of dry loam, did it like the wetness or the scratchiness of the sand?"
"Do all the worms go to the same place?"

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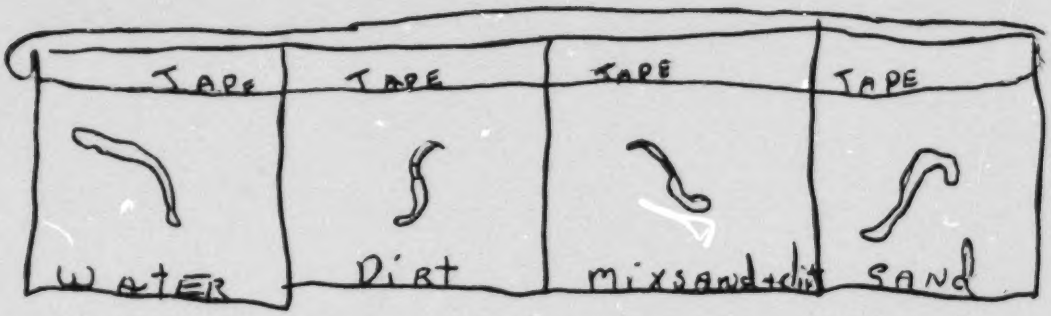


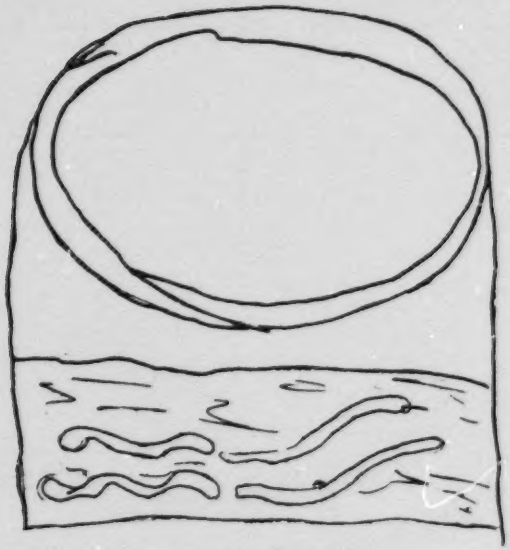
The issue of the reliability of experiments sometimes arises. How many trials must you perform before you can be sure of something?

The whole unit becomes richer when children go outside to find out more about the earthworm's real world and to test their classroom experience by predicting where they will find the largest number of earthworms. Earthworms are so plentiful in many parts of the country that outdoor activities are usually quite rewarding.

In the course of the unit, the children learn directly about the habits and developmental stages of a living creature and develop confidence in their ability to find out things about an animal by themselves.

grade level

This unit has been used in grades three through eight. Younger children have confined themselves to looking at the different life stages and behavior of their earthworms and setting up earthworm homes. Children in grades four through eight have gone on to set up experiments to test their ideas.



scheduling

EARTHWORMS has usually been taught as a whole-class activity. Forty- to sixty-minute periods two or three times a week have been satisfactory for many classes. The long periods are necessary to give the children a chance to check the results of experiments they previously set up, to set up new experiments, and to clean up. The classes should be spaced evenly throughout the week because some of the experiments must be left at least overnight. EARTHWORMS has also been used successfully in some classes as a small-group activity.

Ideally, the children should be able to go outdoors at any time to collect worms and materials or to perform experiments. If this is not possible, try to hold at least a third of the classes outdoors.

If the class is able to go outside regularly, the children will probably spend five to seven weeks on the unit. If this is not possible, they will complete most of the activities in three weeks.

materials

The materials offered in the *Kit*, as described below, are adequate for 15 to 20 students. For a class of 30 it is suggested that two *Kits* be ordered.

Kit of Materials

1 insulated ice chest (to keep worms)

1 scoop (for digging up worms)

15 magnifying lenses

30 plastic spoons

15 work trays

50 6-oz cups with lids

15 plastic, transparent tubes (18" long × $\frac{7}{8}$" in diameter)

30 caps to fit tightly inside ends of tubes

12 containers (2 each of 6 different sizes and shapes)

Other Materials to Have on Hand

1 sprinkler bottle

1 lb of cornmeal, chicken feed, oatmeal, coffee grounds

30 magnifying lenses

1 or more low-power microscopes (about 15×)

enough soil to fill the Styrofoam cooler (A mixture of half soil and half peat moss, leaf mold, or manure is even better. Peat moss is obtainable at hardware and garden supply stores.)

2 ant farms without ants

trowels (for digging up worms)

* Available from Webster Division, McGraw-Hill Book Company, Manchester Road, Manchester, Missouri 63011.

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obtaining earthworms

You may begin the unit with a field trip to hunt earthworms (see page 7 for details of a worm-collecting trip). Prepare the worm box a few days before the trip (see page 11). Earthworms can also be purchased from any of the commercial suppliers listed on page 30. Even if you do collect worms, it is a good idea to buy worms to supplement your supply. The commercially grown worms will usually have egg cases and young worms mixed in with them. Worms that you collect will have to be left undisturbed (except for feeding and watering) for several weeks before they start to multiply. If children have many extra worms, they will feel freer to experiment with them. Usually they won't want to endanger their own personally collected worms by testing them in different kinds of food or soil.

An order of 1,000 worms is sufficient for any classroom and costs about $5. Order "Red Wigglers for breeding." The supplier will send them in bedding that will keep worms in good condition for about a month. If you wish, you may order an extra quart of "rich bedding for breeding worms" to mix with soil in your worm box. The suppliers should deliver the worms within a week's time. If the worms are well cared for, they will multiply, and you will have as many worms as you will ever need for class activities.

field study

EARTHWORMS combines outdoor and indoor studies of worms. The children should have a chance to look outside for worms very early in the unit. During the course of the study, the children will need to go out for additional worms, soil, leaves, and other materials for experiments. If it isn't possible for them to go out at will, plan to spend about every third class outside. This is not a hard-and-fast rule. Sometimes the children will be very involved with their experiments and won't want to be interrupted to go outdoors. At other times, they will be out of materials or won't know what to do next and will welcome the opportunity to explore outdoors.

Looking outside for worms gives children a chance to see the many different kinds of environments there are, with or without worms, even in a small area. Before children go out to look, they usually guess that they'll find worms under rocks or leaves. Once they start to search, they'll discover that worms don't always live where they expect to find them and sometimes live in quite surprising places. The children dig up dirt of different colors and consistencies from the same small hole. They may find that some leafy soil has worms and that some does not.

A worm-collecting trip is a cheap and convenient way to obtain earthworms, but more important, it provides the children with experiences which will raise questions about how worms live. Frequent visits outdoors will provide the class with a continual flow of materials, questions, and ideas for experiments. The children can collect dirt, leaves, grass, and other materials from places where they found worms and from places where there were none, and bring these inside the classroom to set up more experiments about their worms' living preferences. As the children start to get answers to their questions about where worms live, they can test their predictions by going out and looking for worms in new places. One class tried to guess how many worms they would find in a single shovelful of dirt from different places.

"How deep down will the worms be?"
"Does it matter if you look at the top or the bottom of a hill?"
"Can you find worms in the same place every day?"

To go on a collecting trip, you will need pails, shovels or trowels, permission to dig on someone's property, and a lot of enthusiasm. Even children in city classrooms can go on a worm hunt. Vacant lots, alleys, city parks, athletic fields, and lawns are all good places to look. Tell the children to be careful to refill holes and replace chunks of grass when they finish.

the classroom and cleaning up

Working with sand, dirt, or peat moss can be messy. Be prepared to place newspapers, cardboard, paper trays, or similar materials under the buckets of dirt and on each desk. You'll probably have to allow five to ten minutes at the end of each period for cleanup.

records

Many children in trial classes have enjoyed keeping records. If you pass out notebooks for the children to use in any way they desire, many will use them. Children usually record pictures of the animals, observations, experiments, and ideas for experiments. Some children don't feel the need to use notebooks at all.

On May 13, I found that there's a little bump on the end of their head. I think it's because it's going to lay an egg.

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caring for earthworms in the classroom

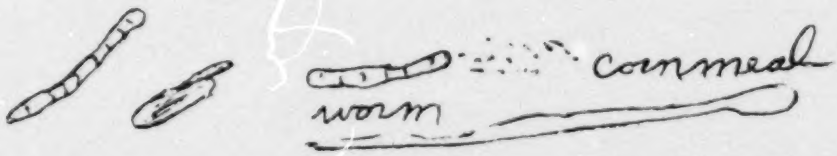
preparing the worm box

At least a day before you get your earthworms, you should prepare a container for them. When you order worms and they arrive before the container is ready, let them stay in a cool place in the bedding in which they were sent until you are ready for them. A Styrofoam picnic cooler or a wooden box about 12 by 18 by 12 inches is large enough for 1,000 worms. If the container has no cover, you can use a piece of heavy cardboard. Cut a hole about 2 by 6 inches in the cover to let air and light into the box, and cover the hole with wire screening or thin cloth to keep out insects.

Fill the box about three-quarters full of soil or a mixture of soil and peat moss, fluffing up this bedding as you put it in. Add some water, and mix it in thoroughly. Repeat this several times until the bedding is moist and crumbly throughout.

Worms that the children collect outdoors can be put directly into the worm box. If you add a lot of worms at once, as after a collecting trip, leave the box alone for two or three days to allow the worms to burrow into the soil.

If you order worms from a supply house, prepare another worm box for them. Plan to put the purchased earthworms in the box at a time when all the children can observe how the worms act in their new home. Dump the worms and bedding into your prepared box, and gently spread everything out. If you are squeamish about this, you may want to wear rubber gloves or let the children do it. The mass of worms that comes out of the bag is both fascinating and repelling. For some teachers this is a bad moment, but soon the worms will settle in and be less conspicuous. If you place a light above the container, the worms will wriggle into the soil faster. Cover



the box, and leave the worms for at least three days, without disturbing or feeding them, to allow them to become acclimated to their new surroundings. Store the worms in the coolest place in the room. Avoid radiators and strong light. Some earthworms arrive from suppliers with small white insects in the soil. Usually these are harmless and will remain in the earthworm box. Occasionally, the soil may become contaminated with mites. (Mites look like tiny red, brown, or white dots and have eight legs.) They multiply very rapidly and are very difficult to kill. Dispose of the whole box and its contents immediately, to prevent the mites from spreading to the children or to other animals or plants in the room.

Always keep the worm box out of direct sunlight and in the coolest place in the room.

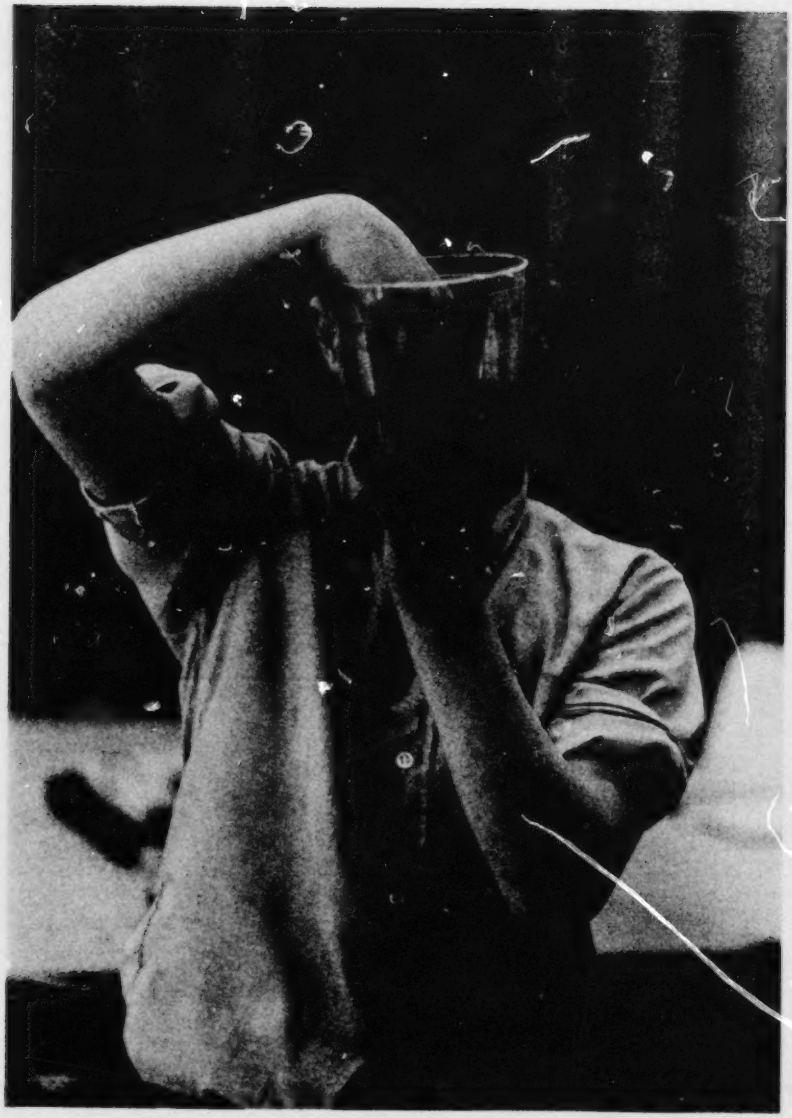
caring for the worms

The children can share the responsibility of caring for the worms in the class box. Each week the worms should be fed, and the bedding should be checked to see that it has not dried out. The soil should look moist and crumbly, but not muddy and wet. Friday is a good day to feed the worms, since they won't be disturbed the next day. If the children set up small individual containers, they will have to check them every day to be sure that the soil doesn't dry out.

To feed the worms, scrape a shallow trough about ½ inch deep and 6 inches wide in the bedding in the center of the worm box. Sprinkle about ¼ cup of cornmeal or other food (see page 4) lightly over this area, and mix it gently with the bedding beneath. Sprinkle the whole box lightly with water. If mold starts to grow in the box, either you have added too much food or water or the temperature is too high. It is best to keep the soil temperature below 75°F. Remove the mold, and don't add any new food for a few days.

About once every three weeks, the children can add a few inches of peat moss to the top of the bedding to freshen it and to increase the amount of bedding as the worms increase in number. If the worms seem crowded as time goes on, prepare a second worm box and transfer half the worms to the new box.

The children can put the worms that they have used in experiments back into the worm box. After these worms have been handled a lot, the children should get some "new" worms from the bottom of the box, to give "used" worms a rest. If you have two worm boxes, you can alternate their use, taking worms from each one on alternate weeks.



classroom activities

introducing earthworms

Once the worms have had a chance to settle in the worm box, the children can begin to study them. Allowing children to take a scoopful of earthworm dirt to their desks on a paper plate or tray is a good way to begin.

Many children will explore the dirt with their hands. A few may be afraid to touch worms. You can reassure them that worms are harmless and can neither bite nor sting, but there is no reason for children to touch them if they don't want to. They can handle the worms perfectly well with spoons and pencils.

Soon the children will see stones, other small round things, sticks, and little worms. Some children may ask if the round things are eggs and the little worms are babies. Occasionally, children have actually seen baby worms hatch from the eggs. They may want to keep the eggs or worms in a separate container to see what happens to them. The paper cups with snap-on lids are useful as worm containers.

As they spend more and more time looking through the soil, the children will become aware of even smaller worms. Someone may set aside a box of "empty" dirt one day and find a baby worm in it the next day. How could this have happened?

Some children spend days just watching their earthworms move around. They watch the worms crawl on the paper tray, on and into the soil, on someone's hand, and on and over each other. They see what happens when one worm meets another worm, bumps into a pencil, or comes to the edge of a desk. This kind of observation is very valuable.

This is a good time to introduce magnifying lenses and low-power microscopes if you have them. The children will watch through their magnifying lenses as the worm stretches and shortens. It takes a great deal of looking to decide whether or not worms have legs, whether they have stripes, or if the "sideways lines squish together" in the front or the back of the worm when it starts to crawl. One child looked at a worm egg under a microscope and saw movement inside.

Many children sit and stare at the worms until they seem to be imagining that they are in the earthworm's world.

> "This worm likes to crawl under the paper plate; it doesn't like to be out in the open."
> "These two worms always tie up in knots."

The children usually notice that the worms start to burrow into the soil as soon as they are put back in the worm box. Some of the children have studied this more closely by putting worms on top of piles of soil on their desks. They can easily find out many things about burrowing.

> "Will all the worms on the tray follow a 'road' bordered with pencils or dirt?"
> "How long does it take to disappear completely?"
> "Does it ever burrow with its tail end?"

Let the children follow up all their questions.

"The little round things don't all look alike—are they all eggs?"
"What do they look like inside?"
"Do the little worms have sideways stripes on them like the big ones?"
"Can you tell the head from the tail end when the worm isn't moving?"

Some of the children may want to see if they can keep their worms alive in paper cups overnight. They may add water or mix into the soil things that they think will help the worms stay alive. They are beginning to experiment but usually haven't singled out what particular things the worms really need to stay alive.

The children may observe mature worms "stuck together" at the light-colored band around the body (clitellum). These worms are mating. When healthy, both worms will produce an egg case every seven to ten days.* Each egg case produces from 2 to 20 worms. The children will find many of the round brownish egg cases, and they can cut some egg cases open to see what is inside. The number of days it takes for an egg capsule to hatch varies for different kinds of worms and can range from several days to a month, so do not be discouraged if yours don't hatch right away.

Children who are watching eggs to see how long they will take to hatch may want to compare their results. Did they all start out with the same kind of round things? Did they use the same sort of container, and water the containers the same amount?

Some of the children may want to raise their baby worms and watch them develop. One girl wanted to keep a small worm separate and measure it as it grew. At first she couldn't decide how to measure it, as its length kept changing. "It's one inch long when it stretches out," she finally announced.

The greater the variety of plastic containers, paper cups, and boxes around, the more opportunity children have to set up many different sorts of ex-

* Earthworms are bisexual; that is, a single worm contains both eggs and sperm. When worms mate, the eggs from one worm are fertilized by the sperm from the other and, at the same time, the sperm from the first worm fertilize the eggs of the second.

periments. The plastic tubes with caps are also very useful (see "Materials"). Children can cut these tubes or tape them together into tunnels, mazes, or other arrangements. Make four holes in the plastic caps to allow for air exchange. The children can do this with a thumbtack or a nail and hammer. It's a good idea to keep some of the caps whole in case the children want some tubes to be watertight or want to test whether or not the holes are necessary.

Some children have set up experiments to let a worm choose between two kinds of environment, such as dark and light, moist and dry, or hot and cold.

outdoor-indoor activities

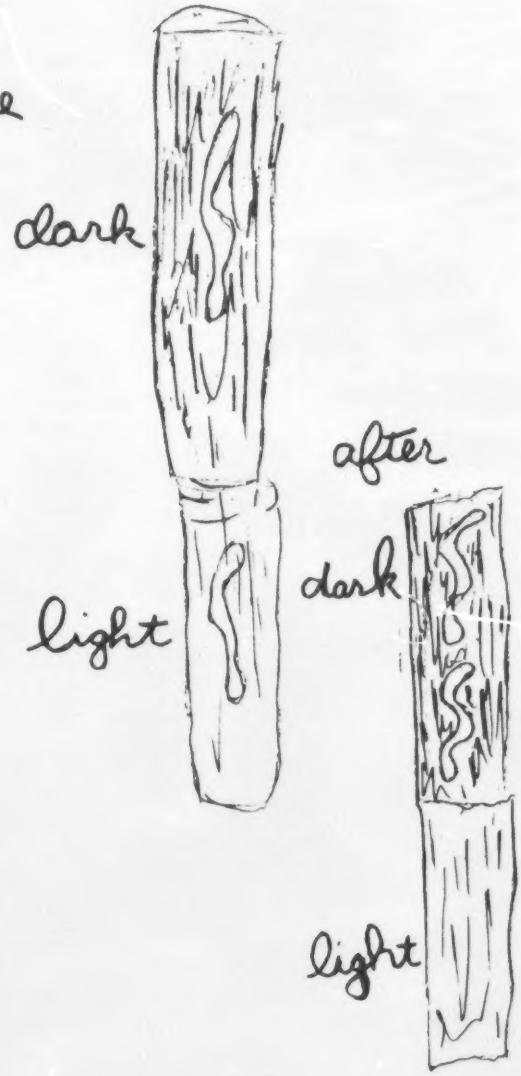
When children work with worms inside the classroom, the question of where worms live outside is often raised:

"They live in the ground."
"They come out after it rains."
"Worms live in gardens."

Children begin to explore vacant lots and their own backyards to test their ideas of where worms are found.

What do the children know about an earthworm's world? What kinds of environments do worms like best? Soil? Wet garden dirt? Darkness? Or does it matter at all?

You might ask, for example, "How can you find out whether worms like dryness or wetness the best?" Children attack this problem in a variety of ways. One girl brought in dirt from in front of her house where she couldn't find any worms. She put worms in a pile of this dirt, in a pile of dirt from the worm box, and in a cup of muddy water, and watched how they acted in each place. Still others put worms aside in different kinds of soil or in soil with water added to see if the worms could stay alive in these environments.



experiments

The early investigations will be quite haphazard and ill-planned. Children will draw immediate and very general conclusions on the basis of one observation or to support some idea they already have about worms. "Worms can't live in sand because my worm went to the soil."

When this happens, try to encourage the children to compare their experiments with one another. One teacher had the children tape summaries of their experiments to the classroom door. That way everyone read them whenever he went through the doorway. The children will probably find that different experimenters reached different conclusions.

> "My worms went from the wet to the dry sand."
> "I kept one in dry dirt and one in wet dirt, and they both lived, so it doesn't matter."
> "Mine jumped around when I put it in sand. I think it was trying to jump out of it, so it must like wet dirt."
> "I put wet dirt and dry dirt in a box, and some of the worms in the dry went over to the wet."

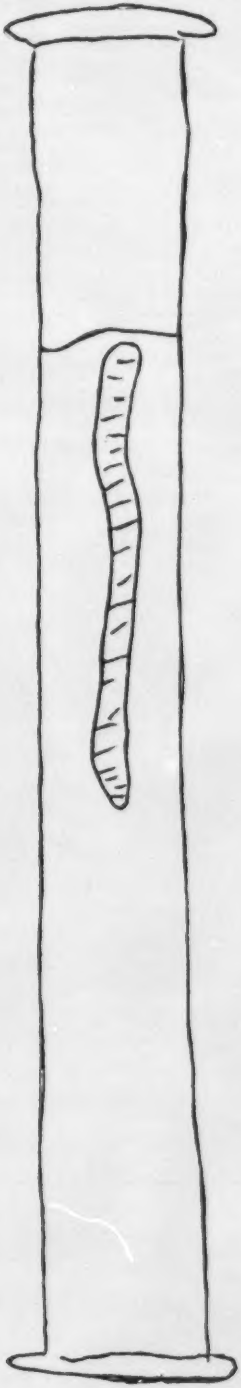
Such disagreements can lead to discussions in which the children work out new experiments to answer their questions. Some children may go outside and try to find dirt similar to what they have been using and see whether or not they can find worms living in it.

It is important for children to be allowed to try out all their ideas. To think out a whole experiment and predict the results without actually having tried different ways of doing the experiment first is a very difficult thing indeed. Most people can do this only after having the experience of setting up many experiments and seeing whether or not the results are of the kind which can help to answer their questions.

Sometimes children feel that an experiment "didn't work" because the results were different from what they had expected. It is difficult, at first, to get children to treat all their results as new information to be examined closely each time.

It is easier for children to ignore data which do not fit in with their ideas of what worms do. Once they start to realize, however, that they can get different and predictable results by changing the way in which they do the experiment, they enjoy analyzing their experiments to see why the results were other then those they had expected. This realization often comes slowly.

One group of children was trying to find whether worms preferred dry or wet soil. The children noticed that some people's "dry" soil was not as dry as others. The teacher gave each of them a paper cup of soil and had them take it home and try to dry it out. Some children placed it in the sun or under a lamp or got permission to dry it out in the oven. One boy then mixed different amounts of very dry soil with moist soil to see how moist the soil had to be before the worms could live in it.



Another class wanted to see whether the worms preferred darkness or light. The children put caps on both ends of their plastic tubes and cut the tubes in half. Then they put dirt in both halves of the tubes and wrapped one half with black paper. They put a worm between the two cut parts and taped the tubes back together. The next day they checked to see where the worms had gone. Some of the children found their worms in the dark side, and some found them in the light side. The teacher suggested that they try the experiment again and, this time, look at each other's setups.

Experimenting with Live Animals – A Comment

In the initial experiments to find out what conditions worms need in order to live, some of the worms may die. This is less likely to happen if the children have already found worms outside, for then they have a better idea of a worm's habitat.

Children working with live creatures exhibit a wide range of behavior. Some children are afraid to handle animals altogether and should not be compelled to do so. Some are squeamish at first but get over this when they see that others are unconcerned. Some will not experiment on their animals for fear of hurting them. Perhaps a class discussion will bring out which kinds of experimentation will not harm the animals.

On May 29 we went out-side to look for worms
We went out right after it had rained.
We went out on the hardtop and saw a
lot of dead worms. They died because
there was to much puddles a they drowned

Most children show good sense in handling animals in the classroom. Some are neglectful. Still others become very casual about killing worms and want to repeat experiments in which worms died. It is easy to forget that worms are living creatures. You can remind the children that worms are alive and that they should consider this fact when they set up an experiment. If they know from earlier experiments that a worm can't live in a certain set of conditions, they should try to find out what factor caused the worm to die and change that factor the next time.

A few children seem to take a positive delight in hurting or killing animals, especially those creatures which seem least like mammals—insects and worms, for example. Often there is little you can do to help a particular child, since he may be expressing feelings you don't know about. It won't help to make him feel guilty or ashamed. It may be enough just to talk it over with him. How you handle this common problem is up to you.

worms in the rain

Most children have noticed that earthworms come out during rainstorms. One class came prepared with boots and raincoats and went on a worm-hunting trip in the rain. They also started to keep track of where they saw worms on the sidewalk.

"Do they come out every time it rains?"
"Do you ever see them when it isn't raining?"

Three boys from the class wanted to see if they could "make it rain" for the worms. They tested to see how many pails of water they needed to pour on a grassy spot to make the worms come up. They also tried to see whether or not the temperature of the water made any difference. The custodian told the children what he did to get worms for fish bait, and they also tried his method. There were discussions about why worms come out in the rain, and this led to further experiments in the classroom and an increased interest in watching worms outside.

"When it rains, the worms come out and crawl into puddles."
"I think there's something in the water they like."

"They all die in the puddles."
"They do not. Sometimes there are 50 worms in a puddle, and they're gone the next day."

Some of the children set up experiments to see if worms would go to water if given a choice, or how much wetness a worm could live in. One girl thought that worms could live in water but didn't like it. She put a rock in the water for the worms to crawl out on. Some other girls lined a large cardboard box with plastic sheeting. They packed dirt up on one side of the box and filled the rest with water. Then they watched to see if the worms would spend most of the time in the "puddle" or in the dirt.

worm food investigations

Worms eat all kinds of organic material in soil. Some children may want to set up a worm box that is like the places where they found worms outdoors and that has natural worm food. They may also wonder what other things the worms will eat.

"What kind of food could they find outside?"
"Can the worms find the food if we just leave it on the top of the soil?"
"Can a worm chew stuff?"

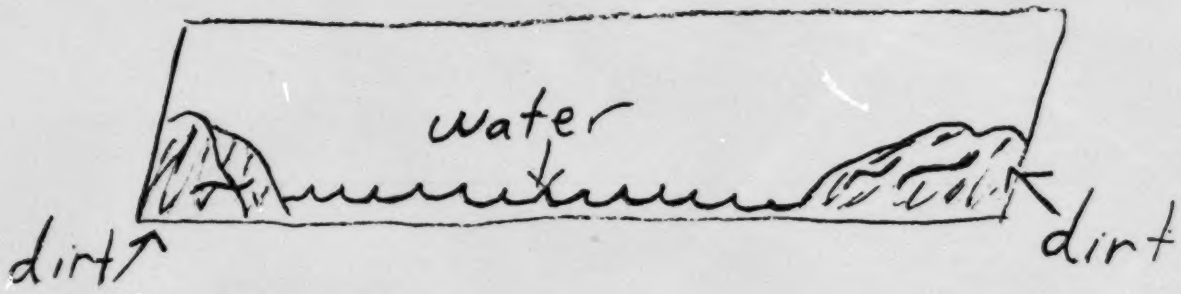
Children have tried feeding worms carrot shavings, hamburger, rotten wood, crushed dried leaves, and oatmeal. It is easy to provide too much food. This may cause mold to grow in the worm boxes. Ask the children to think about the size of a worm, compared to a spoonful of cornmeal. What would the spoonful of cornmeal look like if they were the worm's size?

worm races

In most trial classes, at least one group of children has started to run worm races. The rules for the races and the conditions under which they are run vary greatly. The children usually focus their attention so intently on the worms during the race that they start making detailed observations on how a worm moves, and this often leads to other experiments which are done as races.

One group of children drew a racetrack on a piece of paper. They said that they could predict whether or not a worm would be fast by the way it looked and acted in the dirt. One boy tried to make his worm go faster by tapping lightly on the desk.

In another class, the children set up an experiment to find what kind of surface a worm can move on best. They coated the insides of some plastic tubes with water, cooking oil, or sand and left one dry. Then they compared how their worms crawled through the tubes. They also tested to find how steep an incline their worms could climb in each of the coated tubes.



underground activities

Children ask many questions about what worms do under the ground. If someone has an old "ant farm," it can be adapted for worms, so the children can see them living under the soil; or they can use transparent plastic boxes. If the children cover one or both sides of the ant farm with dark construction paper, it will appear as dark as underground to the worms, and the children can lift the paper to peek into the earthworm world.

Children can try many different things with these earthworm houses. They may fill one with soil, worms, rocks, leaves, and insects that they find on their field trips. If the children put insects in the worm farm, they should cover the top with screening or netting. One class put in a layer of dirt, then a layer of sand, and then another layer of dirt. Some children wanted to see to which layer the worms would go. Others had heard that worms churn up the soil and wanted to see if the layers would move or mix. They used crayon to mark the outside of the glass where the layers met.

The children can also use the plastic tubes to make worm houses. They sometimes enjoy taping several tubes together and then filling them with dirt.

"How long will it take the worm to get to the bottom?"
"If I put it at the bottom, will it crawl up?"
"Will it go faster if I put food at the other end?"
"If I put a layer of sand in the middle, will it stop there?"

winter worms

One class that had found worms in the fall wondered if they could still find worms in the same places that winter. When the children cleared some snow away, they found that the ground was frozen hard. They tried to thaw the ground by pouring hot water on it. One group rolled a large rock away to see if worms would be underneath it. They found some spiders. Some of the children thought that the ground would be soft under the deep leaf pile they had seen in the fall, but they were unable to find it because of all the snow. They decided that they should have marked all the places where they had found worms, so that they could have checked them at different times of the year.

One girl thought that worms wouldn't like cold snow. She put some dirt and some ice cubes on a tray to see which way the worms would go. They went to the ice! This led to other experiments with wetness and with heat and cold.

other animals

When the children go out to hunt for worms, they will find other animals, such as ants, salamanders, frogs, or insect larvae. Some children may find these more interesting than the worms and may become totally involved in watching and caring for these animals. This can be very exciting and challenging, but you should discourage the children from bringing in all the animals they find outside unless they are going to try to keep them alive. Many questions will come up. What will the animal eat? Where was it living outside? Can it live with worms? One boy found a lot of ant lions and put them in different kinds of soil, sand, and gravel to see what kind of material they needed for digging a hole and catching food. He went out each day to collect fresh ants for them. Allowing the children to pursue interesting things such as these, when they come up, can add greatly to their school experience.

appendix

Here are some possible earthworm suppliers:

Oakhaven 51, Cedar Hill, Texas 75104

White Rabbitry, Mt. Vernon, Ohio 43050

Fains Bait Farm, Route 1, Box 64, Edison, Georgia 31746

Andrew Peoples, R.D. #1, Lansdale, Pennsylvania 19446

Red Wigglers, Warsaw 13, Indiana 46580

Mill Creek Ranch, Noel, Missouri 64854

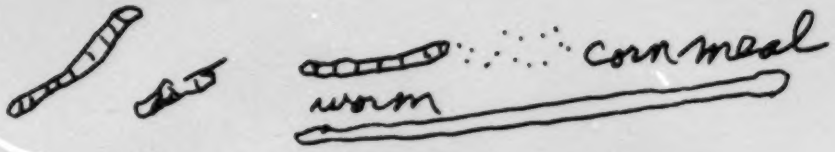
Charles Morgan, Box 1116D, Bushnell, Florida 33513

Carter Worm Farm, Plains, Georgia 31780

Doris Bing, 6419 Palm Drive, Carmichael, California 95608

Worm Gardens, Box 4185, Bellmead, Texas 76705

You can consult gardening magazines, such as *Natural Gardening*, and hunting and fishing magazines for other sources of earthworms.



The worms say cornmeal is delicous.
Worms are long and squgily.
Making a test to see if a worm will go in a test tube
To see how long they can survive in the test tube.
Shake the tubes to see if they get dizzy
Put a worm in a tube and put all kinds of sand and dirt in it